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## Method and Apparatus in a Telecommunication System

### FIELD OF THE INVENTION

5 The present invention relates to an optimisation of the end-user quality of service for Person-to-Person (P2P) packet switched services in mobile networks, e.g. a CDMA-based network or GPRS. In relates in particular to a method and apparatus for network initiated rate control for P2P-services in a mobile system.

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### BACKGROUND OF THE INVENTION

2.5G and 3G mobile systems support different types of Packet Switched (PS) services. Some of these services may support bit rate adaptation. The adaptation of the application bit rate may be necessary when the radio link bit rate is modified.

15 In the radio access layer the offered capacity, i.e. the bandwidth, varies in time. Advanced radio network algorithms aim to reduce the risk that the system reaches an unstable point where the end-users' quality-of-service contract is broken and, at the same time, to maximise the offered quality-of-service for the end-user.

20 As 2.5G and 3G systems works today, the radio access layer reacts quickly, whilst the service/application layer has a long latency before it accommodates to the new radio conditions. This mismatch between the radio access and the application layer implies lower capacity, in terms of the number of users, in the operators' network as well as degraded quality-of-service for the end-users.

The adaptive services may be divided into Person-To-Person (P2P-) and Person-To-Content (P2C-)services. From the bit rate adaptation point of view the main difference is that in P2P case both uplink and downlink may require an adaptation, while in P2C case only the downlink traffic may be adapted.

A special case of P2P-services is when both end users are located in mobile systems. In this case the co-ordination between local and remote entities controlling the air interface is necessary.

10 Even if packet-switched P2P-services are not used today they will have an important role in the future. An example may be video plus speech conversational service.

#### SUMMARY OF THE INVENTION

15 In packet-switched P2P-cases there is a problem in the communication between local and remote Radio Controlling Entities (RCE) that resides in different mobile networks.

It is an object of the present invention to achieve a solution for the above mentioned problems.

20 The proposed solution according to the present invention for bit rate adaptation for two mobile packet-switched P2P-users exploits the bandwidth information retrieved directly from the radio access network.

#### 25 BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, reference is made to the following drawings and preferred embodiments of the invention.

Figure 1 shows an example of a P2P-bit rate adaptation in a UMTS-system.

Figure 2 shows an example of a signalling diagram for bit rate adaptation.

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#### DETAILED DESCRIPTION

The invention makes use of the assigned/employed bandwidth for a particular packet-switched service. This bandwidth information is retrieved from a radio access network and facilitates an enhanced quality-of-service for packet-switched conversational service.

In the service/application layer, there exist no mechanisms to quickly adapt to changed radio network conditions. The applications residing in the clients employ "poor" detection mechanisms for feedback information on the perceived quality-of-service when informing/controlling the originating source, e.g. the speaking party in a packet-switched conversational scenario.

Today, the RTCP-protocol is used to monitor the quality-of-service of real time services on top of the RTP-protocol.

The sender may use RTCP Receiver Reports for throughput estimation to detect a bit rate down-switch. The RTCP feedback messages are not very often as they cannot exploit more than 5 % of the total session bandwidth. For example in case of conversational service with two RTP flows (12.2 kbps audio and 48 kbps video) every flow is controlled in a separate way and the RRs typically cannot be sent more often than once every two seconds for audio stream and twice a second for video stream. More than one RR is necessary to

the sender to perform the correct throughput estimation. In case of real time conversational services there are no application buffers that might compensate the adaptation delay. Thus the packets that cannot be transmitted over the  
5 air interface will be discarded. In case of down-switch from 64 to 32 kbps this may lead to more than 50% packet losses during several seconds. The adaptation delay is particularly critical for P2P conversational services.

Using RTCP there is no efficient way of detecting the radio  
10 channel bit rate up-switch, and therefore increasing the available bandwidth. Channel probing strategy cannot be applied for real time services, as it requires that at least some data are buffered in advance, thus violating the delay requirement. Moreover, a "trial and error fashion" up-switch  
15 cannot be applied, as every erroneous up-switch would cause a long period of packet losses.

One may utilise information directly from the Radio Access Network to quickly balance the mismatch between the offered transport bit rate over the air interface with the  
20 application bit rate,

The main idea of the invention is as follows: A first Radio Controlling Entity RCE-A communicates with a second Radio Controlling Entity RCE-B whenever it modifies the bit rate over the air interface A in uplink and downlink, as  
25 illustrated in figure 1 for a UMTS-network. The bit rate modification is negotiated between the Radio Controlling Entities. Then, the Radio Controlling Entities notify the user equipments (UE) to adapt their sending rate accordingly.

30 Figure 1 shows an example of P2P bit rate adaptation in a UMTS-system. When the uplink and/or downlink bit rate over

the air interface A must be modified the modification is first negotiated between the two respective Radio Network Controllers (RNC-A and RNC-B). Then, the respective user equipments are informed to adapt their sending rates, i.e.

5 the UE-A in the uplink case or the UE-B in downlink case.

The main problem in the adaptation of P2P packet-switched mobile services is to enable the communication between two Radio Controlling Entities that control locale and remote air interfaces.

10 RCE-A might use an IP address of the UE-B to send a rate control message to the RCE-B. RCE-A sends a rate control message containing, among other parameters the IP address of UE-B. This address is used by intermediate nodes, e.g. the GGSN, in order to route the message to RCE-B, which

15 intercepts it.

The IP address of the UE-B may be notified to the control entity A by UE-A, e.g., during the service set-up. Otherwise the control entity A may retrieve the IP address of the UE-B by "sniffing" the user data flow, in particular the IP/UDP

20 header, during the session.

During service initialisation the RCE-A may receive the information about the IP address of the UE-B. Moreover it needs to be notified whether the connection requires the bit rate notification service.

25 The UE-A could pass the IP address of the sender application user to RCE-A during the service set-up by means of a new IE in RANAP/SM protocols. The presence of this IE will indicate that the service requires the network feedback. The IP address of the UE-B is known to the UE-A by means of initial

30 application signalling, e.g. SDP.

Figure 2 shows an example of a signalling diagram illustrating the adaptation over the air interface A. When the channel bit rate over this interface must be modified RCE-A sends a rate control message to GGSN-A. The message must contain the new bit rate value, direction, i.e. uplink or downlink, and the IP address of UE-B. GGSN-A checks the IP address of UE-B in order to understand if UE-B resides in the mobile packet-switched network. In this case GGSN-A forwards the RCE-A message to the corresponding GGSN-B. This GGSN-B delivers the message to RCE-B, which checks if the required bit rate modification is possible over the air interface A and replies with a corresponding acknowledgement or non-acknowledgement (ACK/NACK) message to the RCE-A. In positive case the channel bit rate is switched and the user equipments are notified to adapt their sending bit rate.

The following describes an example of an adaptation of the air interface A in case of a UMTS packet-switched network:

Regarding the downlink adaptation, when RNC-A modifies the downlink bit rate, UE-B must adapt its sending rate, i.e. the bit rate modification must be negotiated with RNC-B and delivered to UE-B. The down-switch case is particularly time critical. When the channel bit rate is down-switched, the application bit rate must be adapted as soon as possible in order to avoid packet losses. RNC-A sends the bit rate modification message to RNC-B, which replies with an acknowledgement (ACK) and switches the channel bit rate. The RNC-B notifies UE-B, which modifies its sending rate accordingly. For the up-switch, the negotiation between the Radio Network Controllers (RNC-A and RNC-B) is necessary in order to avoid the waste of resources over the air interface A in case that the bit rate over the air interface B cannot be up-switched. If RNC-A has additional resources in its downlink it notifies this to RNC-B. RNC-B checks if it is possible to switch up the uplink rate over

the air interface B and replies with an acknowledgement or non-acknowledgement (ACK/NACK). In case of a positive acknowledgement UE-B is notified to switch up its sending rate.

- 5 Regarding the uplink adaptation, when RNC-A modifies the uplink bit rate, UE-A must adapt its sending rate. In order to avoid an overload or waste of radio resources over the air interface B such modification must be previously negotiated with RNC-B. The up- and down-switches are
- 10 performed in the same way as described above for the downlink adaptation.

The present invention permits to adapt in a quick and accurate way the application bit rate to the air interface conditions, which is not possible with current technologies.

- 15 The bit rate adaptation over air interfaces controlled by two different radio control entities is co-ordinated and makes it thus possible to avoid the overload or the waste of resources over one of the air interfaces. By means of the present invention the operator has the possibility to
- 20 control and optimise the provided quality-of-service.

The solution is general and may be applicable for all types of adaptive PS P2P services between two mobile users and for any 2.5G/3G mobile system

CLAIMS

1. Method in a mobile communication system comprising at  
least two Radio Controlling Entities (RCE) that reside in  
5 different mobile networks,

c h a r a c t e r i s e d b y

a first Radio Controlling Entity (RCE-A) informing a second  
Radio Controlling Entity (RCE-B) on modifications of the bit  
rate over its air interface in uplink and/or downlink,

10 the first and second Radio Controlling Entities (RCE-A, RCE-  
B) negotiating said bit rate modifications,

the first and second Radio Controlling Entities (RCE-A, RCE-  
B) notifying the user equipments (UE-A, UE-B) to adapt their  
sending rates accordingly.

15 2. Arrangement in a mobile communication system comprising  
at least two Radio Controlling Entities (RCE) that reside in  
different mobile networks,

c h a r a c t e r i s e d i n

means for informing a second Radio Controlling Entity (RCE-  
20 B) on modifications of the bit rate over the air interface  
of a first Radio Controlling Entity (RCE-A) in uplink and/or  
downlink,

means for negotiating said bit rate modifications,

means for notifying the user equipments (UE-A, UE-B) to  
25 adapt their sending rates accordingly.

ABSTRACT

In person-to-person packet switched services in mobile networks there is a problem in the communication between  
5 local and remote Radio Controlling Entities (RCE) that resides in different mobile networks. The present invention for bit rate adaptation for two mobile packet-switched P2P-users exploits the bandwidth information retrieved directly from the radio access network by means of informing on  
10 modifications of the bit rate in uplink and/or downlink, negotiating said bit rate modifications, and notifying the user equipments to adapt their sending rates accordingly.

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Handwritten notes

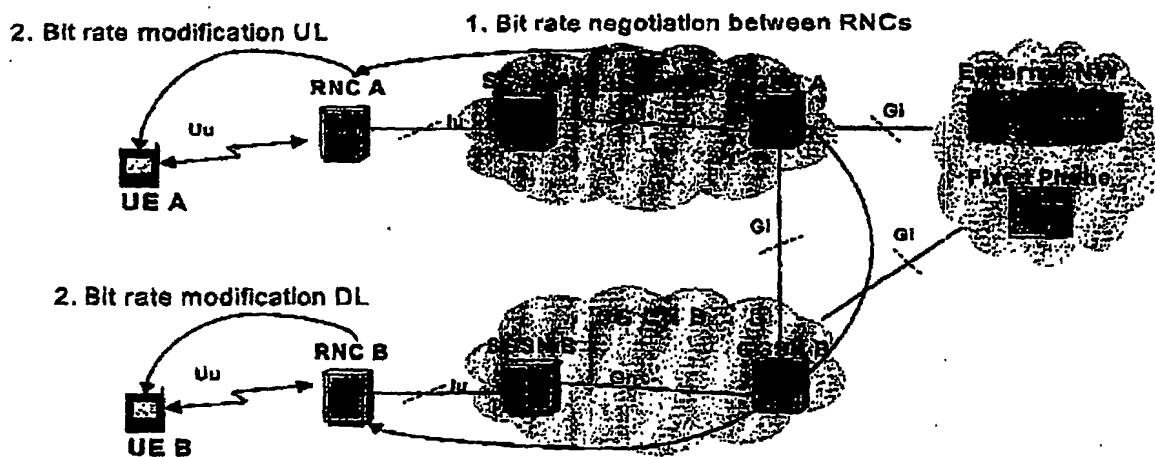


Figure 1

